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Title of Lesson: Whole Lotta Shakin' Goin' On: Tectonic Changes along the Pacific Rim

Author/Designer(s): Pam Merrill

Grade Level (s): 6 and 7 grades

Time Recommended: 3 class periods

Overview: *(Brief paragraph describing the major goals and activities of the lesson.) Using a variety of online, print, and visual evidence, students will be challenged to defend of refute the label, Ring of Fire, as an accurate and appropriate description of the physical region of the Pacific Rim and its history, as well as future potential for devastating tectonic events. As a conclusion to student investigations, students will create and publish their findings in an online, digital journal. The lesson is most effective if students have access to the internet at multiple stages of the lesson; however, options are available should access be limited.* ***Geography for Life*** **National Standards:**

1. How to Use Maps and Other Geographic Representations, Tools, and Technologies to Acquire, Process, and Report Information From a Spatial Perspective

3. How to Analyze the Spatial Organization of People, Places, and Environments on Earth's Surface

4. The Physical and Human Characteristics of Places

7. The Physical Processes That Shape the Patterns of Earth's Surface

15. How Physical Systems Affect Human Systems
16. How to Apply Geography to Interpret the Past

Oklahoma State Academic Standards

OAS 2012	OAS 2019
Grade 6. 3. The student will examine the interactions of physical systems that shape the patterns of Earth's surface.	**6.2** The student will analyze the physical systems of the major regions of the Western Hemisphere.
2. Describe how the processes and factors of latitude, elevation, Earth-Sun relationship, prevailing winds, and proximity to bodies of water influence climate and how humans respond to regional climate patterns and events.	**6.2.2** Explain how the processes and factors of latitude, elevation, Earth-Sun relationships, prevailing winds, and proximity to bodies of water influence climate.

3. Analyze the impact of natural disasters on human populations including forced migration, scarcity of consumer goods, and loss of employment.	**6.4.3** Analyze the impact of climate and natural disasters on human populations, including forced migration, scarcity of consumer goods, economic activities, and loss of life.
Grade 6.1 and 7.1. The student will analyze data from a geographic perspective using the skills and tools of geography.	**6.1** The student will analyze data from a geographic perspective using the skills and tools of geography. **7.1** The student will analyze data from a geographic perspective using the skills and tools of geography.
1. Cite specific geographic information to support analysis from primary and secondary sources located in texts, documents, newspapers, magazines, journals, political cartoons, and online news sources.	**7.1.1** Integrate specific geographic information to support analysis from primary and secondary sources located in texts, documents, newspapers, magazines, journals, political cartoons, and online news sources.
2. Integrate visual information, draw conclusions, and make predictions from geographic data and analyze spatial distribution and patterns by interpreting that data as displayed on globes, graphs, charts, satellite and other forms of visual imagery including data from bar and line graphs, pie charts, thematic maps, population pyramids, climagraphs, cartagrams, contour/relief maps, GIS systems, and diagrams.	**7.1.5** Integrate visual information, draw conclusions and make predictions from geographic data and analyze spatial distribution and patterns by interpreting that data as displayed on geographic tools.
5. Conduct short research projects by investigating contemporary events and issues from political, economic, social, and geographic perspectives.	**7.1.6** Describe and analyze the role of geographic factors on current events and issues.
Grade 7.2. The student will examine the human and physical characteristics of the major regions of the Eastern Hemisphere.	**7.5** The student will compare common physical and human characteristics of regions which create identity or uniqueness and influence people's perceptions of the Eastern Hemisphere.
2. Integrate visual information in order to describe the characteristics and relative location of physical and cultural regions of the Eastern Hemisphere including the Pacific Ring of Fire.	**7.2.1** Identify on a physical map the major landforms and bodies of water of each region**.**
Grade 7.3: The student will examine the interactions of physical systems that shape the patterns of Earth's surface in the Eastern Hemisphere.	**7.2** The student will analyze the physical systems of the major regions of the Eastern Hemisphere.

2. Analyze from multiple perspectives the impact of natural disasters on human populations resulting in forced migration, scarcity of consumer goods, and loss of employment including the impact of plate tectonics resulting in earthquakes, tsunamis, and volcanic eruptions on human and physical systems bordering the Pacific Ring of Fire.	**7.4.1** Analyze the impact of climate events, weather patterns and natural disasters on human populations and the environment, resulting in forced migrations, scarcity of consumer goods, economic activities, and loss of life.

Resources and Materials Needed: *(List of all special materials, print resources, etc.)*

Instructor computer, viewing screen, and internet access

Set of List, Sort, Label, Predict Geographic Concepts/Vocabulary Cards

(one set per pair of students)

Copies of handouts (news articles, political cartoons, maps) included in this lesson

(one set of handouts for each group of 4 students)

Highlighters (one color per pair of students)

Student access to computers, laptops, mobile devices, etc. and the internet

(one per pair of students)

4-Corner Signs for the classroom

Procedures:

ENGAGE

This introductory step of the lesson should stimulate the students' curiosity and activate prior student knowledge. The activity should be a problem or an event that raises qu estions and motivates students to discover more about the concept. Guiding

Questions:

- *How will the teacher capture students' interest?*

Inform students that they will be investigating one of the largest, in not THE largest physical region on Earth- the Pacific Rim. Without offering any additional information, give pairs of students a set of the List, Sort, Label, Predict cards included in the lesson. Give pairs 4 minutes to sort the cards (geographic concepts) into no less than 2 and no more than 4 categories (classifications) based on their current knowledge of each term and how those terms relate to one another. Using a sticky note or slip of paper, partners will create a title (label) for each of the categories created. Allow time for students to leave their desks and walk about the room to view the classifications and labels of other teams. What do they see in common with other partners' labels? Returning to their desks, ask partners to create a one-statement prediction about the focus on the lesson, based on the clues given in this set of geographic terms. Ask each partnership to verbally share their statement with the class.

EXPLORE

Students need the opportunity to actively explore concepts in a hands-on activity. This establishes a commonly shared classroom experience while students are actively engaged with little explanation from the teacher. Students help each other understand the concept through social interaction. Guiding Questions:

- *What hands-on/minds-on activities will students be doing?*
- *What are the "big idea" conceptual questions that the teacher will use to encourage and/or focus students' exploration?*

1. Inform the class that many of their predictions are correct; we will be studying the physical characteristics which have led scientists and the general public to refer to the Pacific Rim region as the "Ring of Fire." Assign each partnership to join with another pair of students to form a group of 4. Each group will be investigating evidence (news articles, maps, political cartoons, which will either support or refute the accuracy of the title "Ring of Fire."
2. Advise groups to begin with analysis of the Map of the World's Tectonic Plates. Discuss observations and conclusions they draw from the map. What do they know about movement of the Earth's plates? What do they know about the effects of such movements on human populations?
3. Advise groups to investigate the remaining pieces of evidence, with the following guidelines: Use highlighters to denote evidence from news articles which support the title of "Ring of Fire"; Use the TACOS analysis guide to breakdown the artist's message regarding physical events of the Pacific Rim; (optional) respond in writing to the three questions posed during the online

EdPuzzle presentation, "What and Where Ring of Fire" (https://edpuzzle.com/media/571f9b13f47cca4141003819) ; and (optional) review the Prezi online presentation, "Ecuador's Earthquake" (https://prezi.com/xvcb9hnfowqh/ecuador-earthquake/).

EXPLAIN

Teachers present or lead student discussion of information discovered during the "explore" stage. Teachers introduce new terms and explanations at appropriate times during the discussion. Guiding Questions:

- *What questions or techniques will the teacher use to help students connect their exploration to the concept(s)?*
- *What are the higher order thinking questions that teachers will use to solicit student explanations?*

Inform the class that they will be joining you in an online tour of the Pacific Rim. Ask students to follow along if they have their ow mobile devices (Tourbuilder link- http://goo.gl/x9i3rT); however, a whole class instruction is satisfactory. Use the stops on this tour to explore the maps, video clips, and photographs depicting the effects and human responses to the many tectonic events that have occurred around the Ring of Fire. Pause to elicit discussion or reactions from the class. Advise students to continue mentally gathering evidence to support or refute the claim that "Ring of Fire" is an appropriate title for this region.

EXPAND

Students apply, extend, and enhance the new concept and related terms during interaction with other students. Providing additional active opportunities for students to apply the concept(s) allows them to expand their understanding.

Guiding Questions:
- *How will students develop a more sophisticated understanding of the concept?*
- *What vocabulary will be introduced and how will it connect to students' observations?*
- *How is this knowledge applied in our daily lives?*

Ask students to return to their original partnerships. They will be offered time in a computer lab or with their mobile devices to complete independent research and to create an online product, using the web-based tool, StoryJumper. Inform partner that they will be serving as news reporters, covering two major natural disasters occurring on both the eastern and western boundaries of the Ring of Fire. Each team will be representing one of the two most significant and successful news organizations in the world- the Associated Press (AP) and Reuters. Teams who will be working for AP will be assigned to cover the events in Nicaragua and Indonesia. Teams who will be working for Reuters will be assigned to cover the events in Ecuador and Japan. Remind students that they have been introduced to each of the natural disasters through the TourBuilder presentation; however, they must seek further detailed and reliable information by accessing additional internet sources. Give each team a set of directions and expectations included in this lesson (Ring of Fire Digital Journal). (Option: if access to computers is not available, students may be required to note additional information from the Tourbuilder presentation, using this information to create a foldable or paper journal, comparing and contrasting the assigned paired examples of natural disasters.)

EVALUATE

Students demonstrate their understanding of the concept.

Guiding Questions:
- *How will students demonstrate that they have achieved the lesson objective(s)?*
- *How will evaluation be embedded throughout the lesson as well as at the end of the lesson?*

Conduct a brief Four-Square Opinion Continuum, asking one representative from each group to stand in one of 4 corners of the room (labeled "Strongly Agree" "Agree" "Disagree" and "Strongly Disagree") as they respond to the statement, "The title of Ring of Fire is fitting for the Pacific Rim region." Ask representatives in each corner to justify their stance using a specific piece of evidence gleaned from the partnership's investigations.

Enrichment and/or Extension of the lesson
(Optional):

Interested students may wish to explore the events, impact, and human responses to the Japanese tsunami by accessing a Livebinder collection (http://www.livebinders.com/play/play?id=78983) of visual and written evidence published immediately after the event. Based on this exploration, students may develop and present to the class a formal recommendation for all nations bordering the Ring of Fire, listing steps government officials, community organizations, and individuals can do to alleviate the effects of another similar tectonic event. **References:**

Geography in the News, by Neil Linebeck https://php.radford.edu/~vga/?p=3590
National Geographic Society http://nationalgeographic.org/encyclopedia/ring-fire/
Earth Sky.org http://earthsky.org/earth/what-is-the-ring-of-fire
Universe Today http://www.universetoday.com/59341/pacific-ring-of-fire/

Resources:

OKAGE's geography resources:
http://www.okageweb.org/resources/ http://www.okageweb.org/member-resources/

http://www.okageweb.org/helpful-links/

Oklahoma Council for the Social Studies (OCSS) and Oklahoma Social Studies Supervisors Association (OSSSA) Geography Resources for Grades 6 and 7 World Geography.
http://okcss.org/whats-new.html

List, Sort, Label, Predict

Working in teams of 2-3, cut apart these terms. Sort into no less than 2 and no more than 4 categories (classifications) based on your knowledge of each term and how they relate to one another. Using a sticky note or slip of paper, create title (labels) for each of the categories you have created. Walk about and view the classifications and labels of other teams. What do you see in common? Return to your team and create a one-statement prediction about the focus on the lesson, based on the clues given in this set of geographic terms.

fault	earthquake	plates
volcano	lava	magnitude
islands	Pacific Rim	tsunami
floods	coastal city	tidal wave

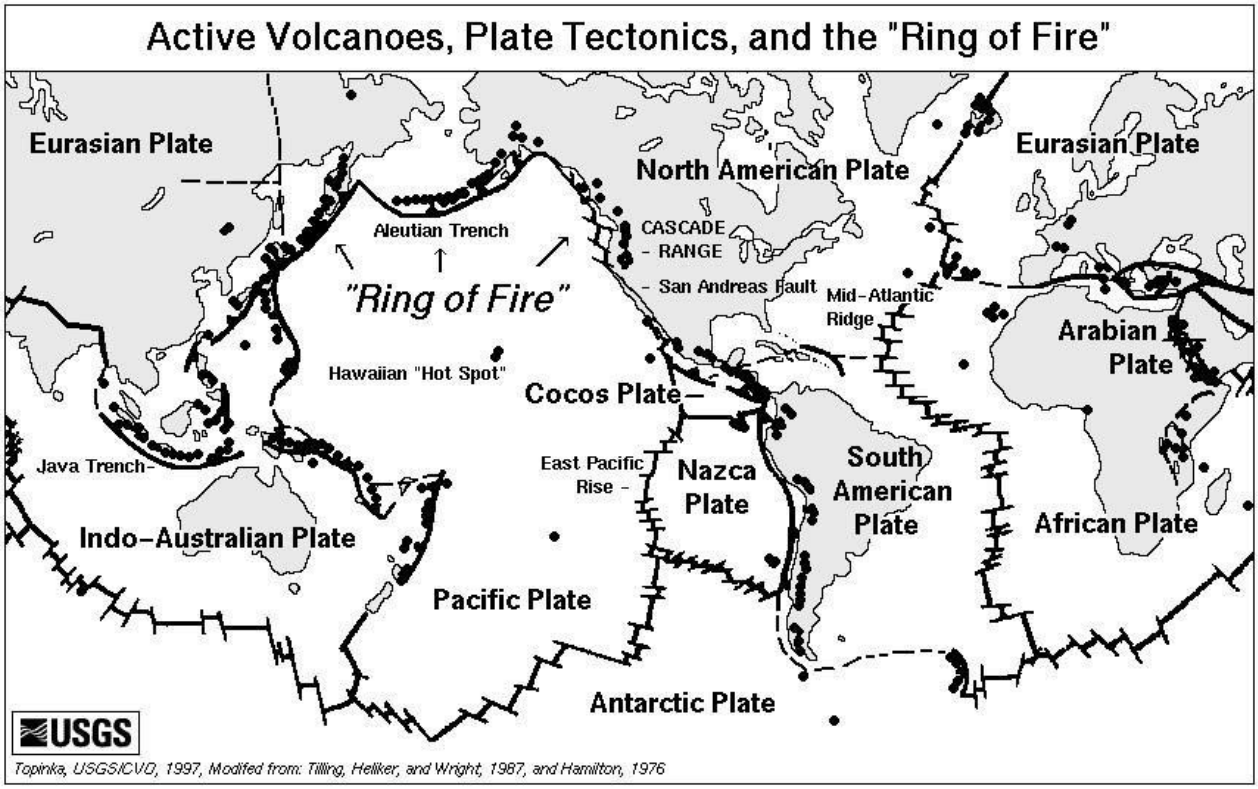
Chile and the Ring of Fire

One of the really "Big Ones" to shake the United States was a magnitude earthquake of 9.0 along the Pacific Northwest coast more than 300 years ago…Were it to occur today, seismologists say enormous destruction and loss of life would result in a region home to millions of people. The magnitude 8.8 that rocked Chile and sent tsunami fears across the Pacific recently, just weeks after the deadly quake in Haiti, served as a reminder of the perils of living along the fault lines of shifting plates.

Stricter building codes in Chile played a major role in reducing the loss of life, as compared to the Haiti earthquake. As technology and construction techniques have improved, it has minimized the loss of life in many Andes countries.

Chile sits on the "ring of fire"- a system of geological faults that circles the Pacific Ocean. In 1906, a magnitude 8.6 near Valpraiso killed 20,000 people, but the quake of 1960 shattered the records for the strongest on record- a magnitude of 9.5. After that quake, Chile imposed strict rules about building materials. It has one of the most modern engineering codes in the world! In Chile, they have been preparing for this moment for a long time. Many of the deaths in Haiti could have been prevented by using earthquake-resistant designs and construction. Similarly, experts in the United States warn that 26% of our bridges are structurally deficient and many public buildings in "quake zones" are hazardous.

Examining the evidence of the past and recent events gives scientists reason to predict that the Pacific coast of the United States has a one in ten chance for another "Big One" in the next 50 years. That's enough warning for society to make some serious decisions about how we build our homes, schools, offices, and hospitals.

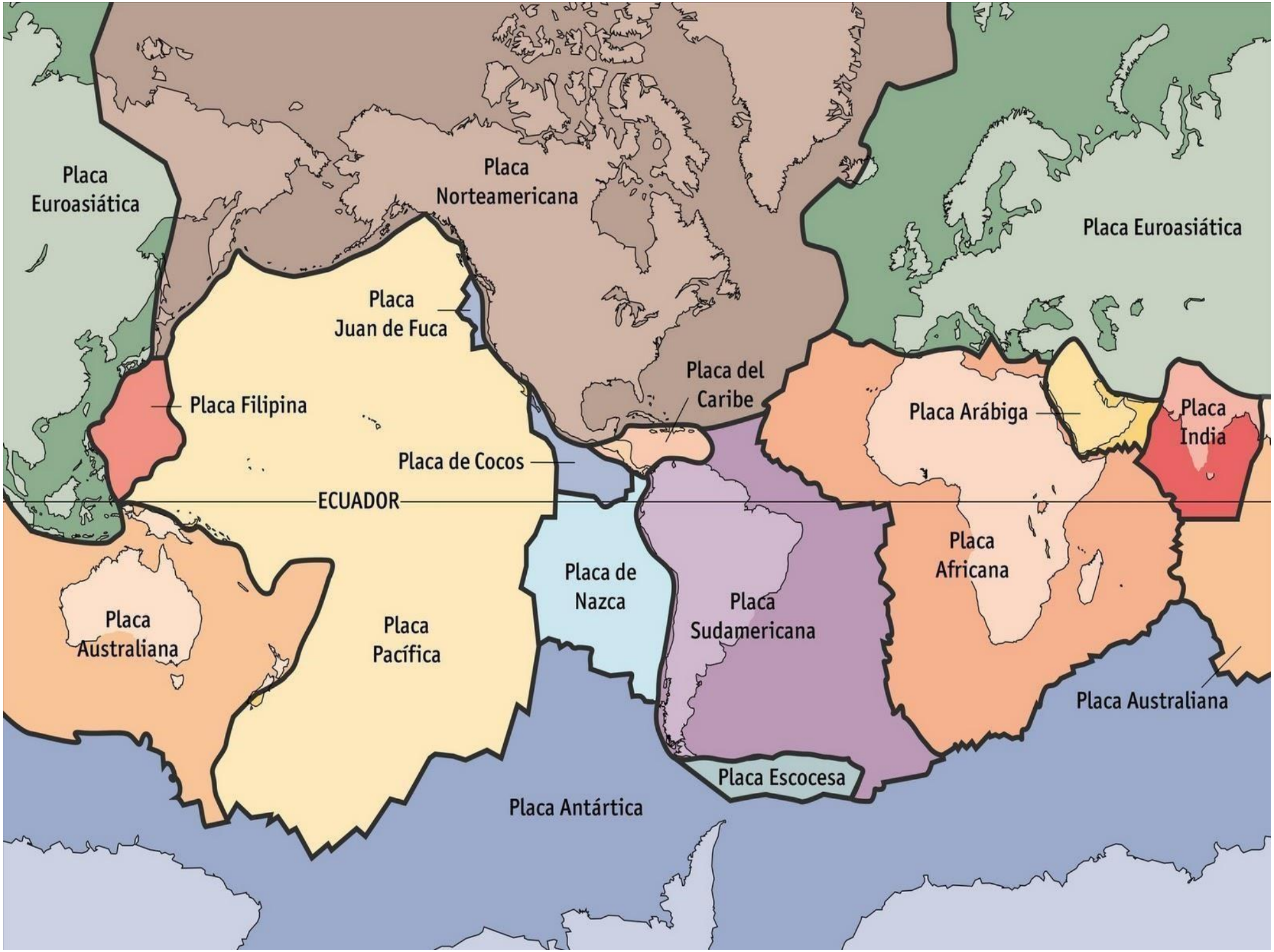


After reading about recent earthquakes in the western hemisphere, identify three ways in which humans are affected by the environment AND three ways in which humans *have* changed or *can* react to their environment along the "Ring of Fire."

HUMAN-ENVIRONMENT INTERACTION CYCLE

How has the environment of the "Ring of Fire" changed people's lives?

How can or have people living along the Ring of Fire change their environment?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Placa del Caribe
Placa Filipina
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Placa India
Placa de Cocos
ECUADOR
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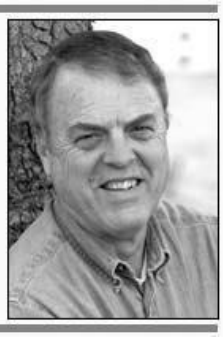
Placa Escocesa
Placa Antártica

Geography In The News™



Neal G. Lineback

DEVASTATING TSUNAMI!

One of earth's most devastating and powerful natural hazards is the tsunami. Yet until recently most of the worldeven many coastal dwellers—had never heard of this ocean wave of all waves.

On December 26, 2004, a 9.0- magnitude earthquake off the west coast of northern Sumatra generated a gigantic tsunami that radiated outward in all directions from the earthquake's epicenter. Although the intense earthquake killed some people, the huge tsunami waves killed most of the estimated 60,000 to 100,000. Coastal residents throughout South and Southeast Asia were impacted and some deaths occurred as far away as Somalia in East Africa.

Tsunamis (sue-NAH-mes)—also called seismic sea waves—are different from all other ocean waves. In fact, almost all other ocean waves are created by wind blowing over water. *Tsunami* is a Japanese word now accepted throughout

throughout the history of the earth.

Any of these causes can displace ocean water, creating seismic waves, or shock waves, that radiate away from the source. The geographic pattern is much like the circles that spread outward when a pebble is dropped into a lake.

There are fundamental differences, however. Seismic waves move along the ocean floor at speeds as great as 600 m.p.h. (1,000 k.p.h.). The energy creating the tsunami is transferred to the water just above the speeding seismic wave. On the surface of the deep ocean, the tsunami's passing is hardly perceptible, perhaps generating only low ocean swells.

As the tsunami reaches shallow waters of coastal regions, however, energy is compressed between the ocean floor and the water surface. This first creates a trough, whereby ocean water retreats from the shore, then surges forward. As the water returns, the drag along the ocean floor creates enormous curling waves.

The surge, not unlike a storm surge, results from waves literally piling on top of one another, sending water tearing through coastal zones for great distances from the beach. Damage and loss of life from such tsunamis can be horrific.

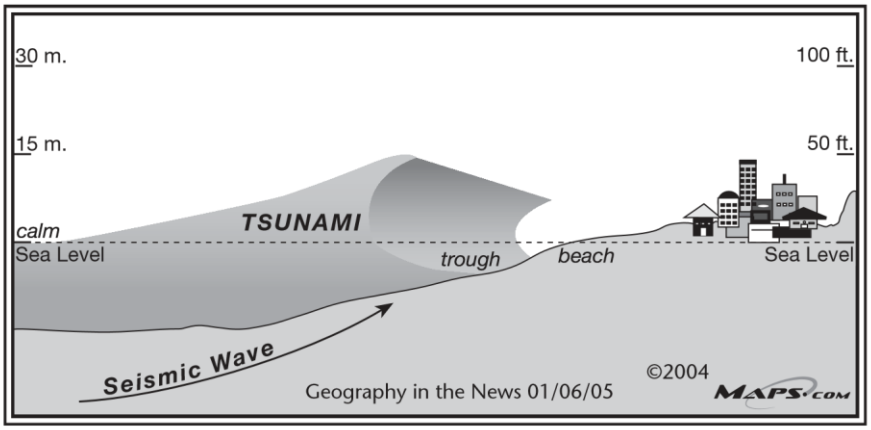
Although all coastal zones are susceptible to tsunamis, those facing active margins of the earth's tectonic plates are particularly so. Pacific islands experience frequent tsunamis because the margins of the Pacific Ocean's plates are very active geologically.

For example, the Hawaiian Islands, located near the center of the Pacific Ocean, have experienced numerous tsunamis. A May 22, 1960, earthquake off the coast of Chile created a Pacific-wide tsunami with an estimated loss of life at more than 1,000. The tsunami arrived at

Tsunami Warning!

Hilo, Hawaii, covering the 7,200 miles (11,600 km) in less than 15 hours. According to the National Geophysical Data Center, sixty-one died in Hilo and the damage was estimated at $24 million.

There are two historical tsunamis that stand out for extreme losses of human life. Krakatoa (KRACK-ah-TOE-ah), a volcanic island located between Java and



Sumatra in present Indonesia, literally blew its top and collapsed back into the ocean in 1883. The gigantic tsunami that spread from the island killed an estimated 36,000 people on surrounding shores and as far away as the Ganges and Brahmaputra deltas at the head of the Bay of Bengal.

The tsunami from a similar explosion and collapse of the Mediterranean volcano of Santorini in 1450 B.C. left a wave mark 1,500 feet (457 m) above sea level at the eastern end of the Mediterranean Sea.

Tsunami wave scars of similar or higher elevations are recorded around the world from earthquake events, notably in Alaska. Scientists suspect that asteroid impacts in the earth's history may have generated tsunami several times higher than those associated with the highest caused by earthquakes.

The U.S. National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey help monitor tsunami potentials around the world. These agencies provide information to groups such as the Pacific Tsunami Warning System about speed, timing and size of tsunamis.

The latest Sumatra earthquake and tsunami struck when coastal hotels across the region were filled to capacity with holiday vacationers from around the world,

many escaping the cold Northern Hemisphere winter. Whole villages were swept away, making it very difficult to obtain an accurate death count. phy in the

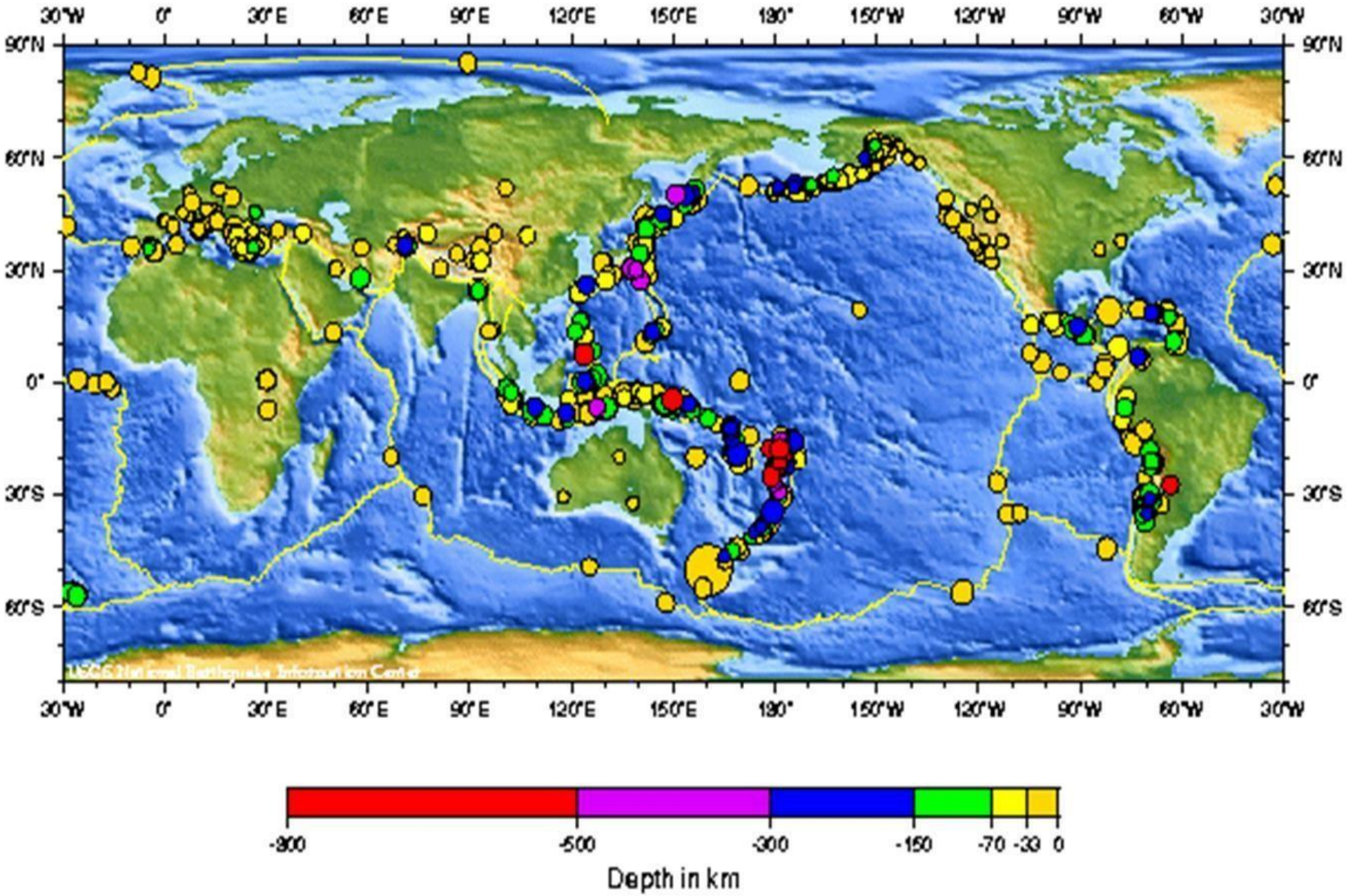
Most earth scientists will agree that the potential for loss of life from tsunamis in coastal regions of the world exceeds even that of earthquakes and hurricanes for any given decade. The loss of life from the recent tsunami in South and Southeast Asia is the greatest in recorded history.

And that is Geogra-

News™, December 31, 2004. #766.

(The author is a professor and Interim Dean of the College of Arts & Sciences at Appalachian State University, Boone, NC. Note to Editors: This article, GITN 766, "Devastating Tsunami!" is a revised version of GITN 432, "Tsunami," written and published by the author on February 23, 1998.)

Last 8 to 30 Days of Earthquake Activity

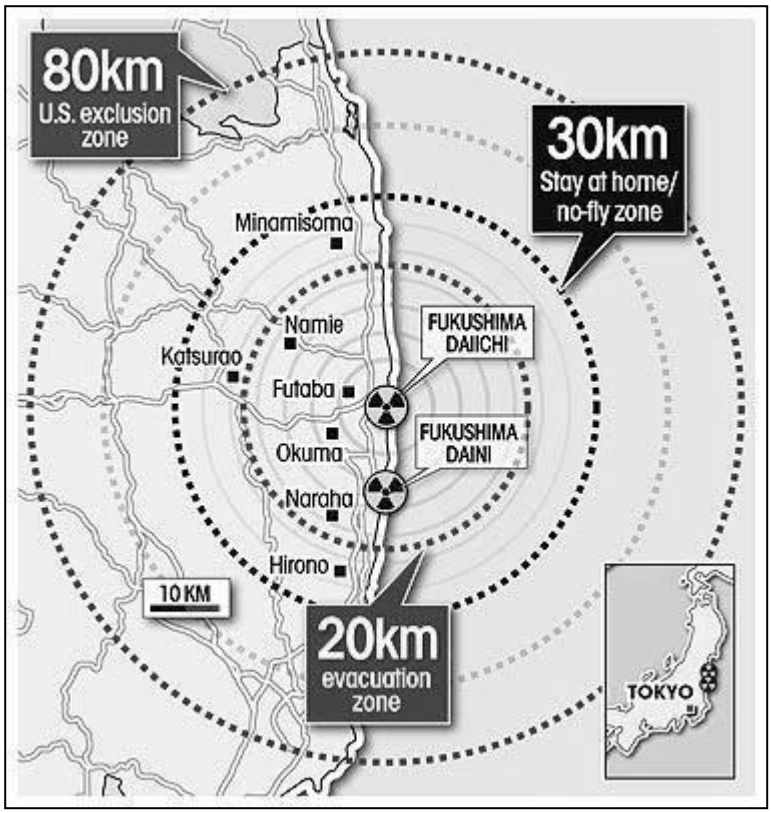


JAPAN'S TRIPLE DISASTER

This March, Japan experienced three disasters of colossal proportions. Any one of the three by itself would have riveted global news media. A major earthquake off the northeast coast of the main island of Honshu registered 9.0 on the Richter scale, making it one of the strongest ever recorded. The earthquake and its displacement of water generated a tsunami of great magnitude, sending a 30-foot wall of water crashing into the coastal lowlands and flowing as far as six miles inland destroying nearly everything in its path. The tsunami inundated two nuclear reactor complexes, causing loss of power to the cooling machinery in at least one of the two. At least three of the nuclear reactors and a spent nuclear rod storage facility overheated or caught on fire, releasing radiation into the atmosphere.

The effects of these three disasters are far-ranging. Relief organizations rushed to assist refugees from the earthquake and tsunami, assisting the more than 500,000 residents left cold and hungry, many with limited shelter. An estimated 30,000 were rescued and more than 10,000 were killed in the disaster. Quickly, however, the problems associated with the damaged nuclear reactors and storage facilities dominated the news media.

The Pacific Ring of Fire long has been the most active large-scale geologic region for major earthquakes, volcanoes and tsunamis. Around these margins of the Pacific Ocean, tectonic plates are colliding.
Therefore, the root cause of all three of Japan's disasters was the earthquake associated with the Ring of Fire.

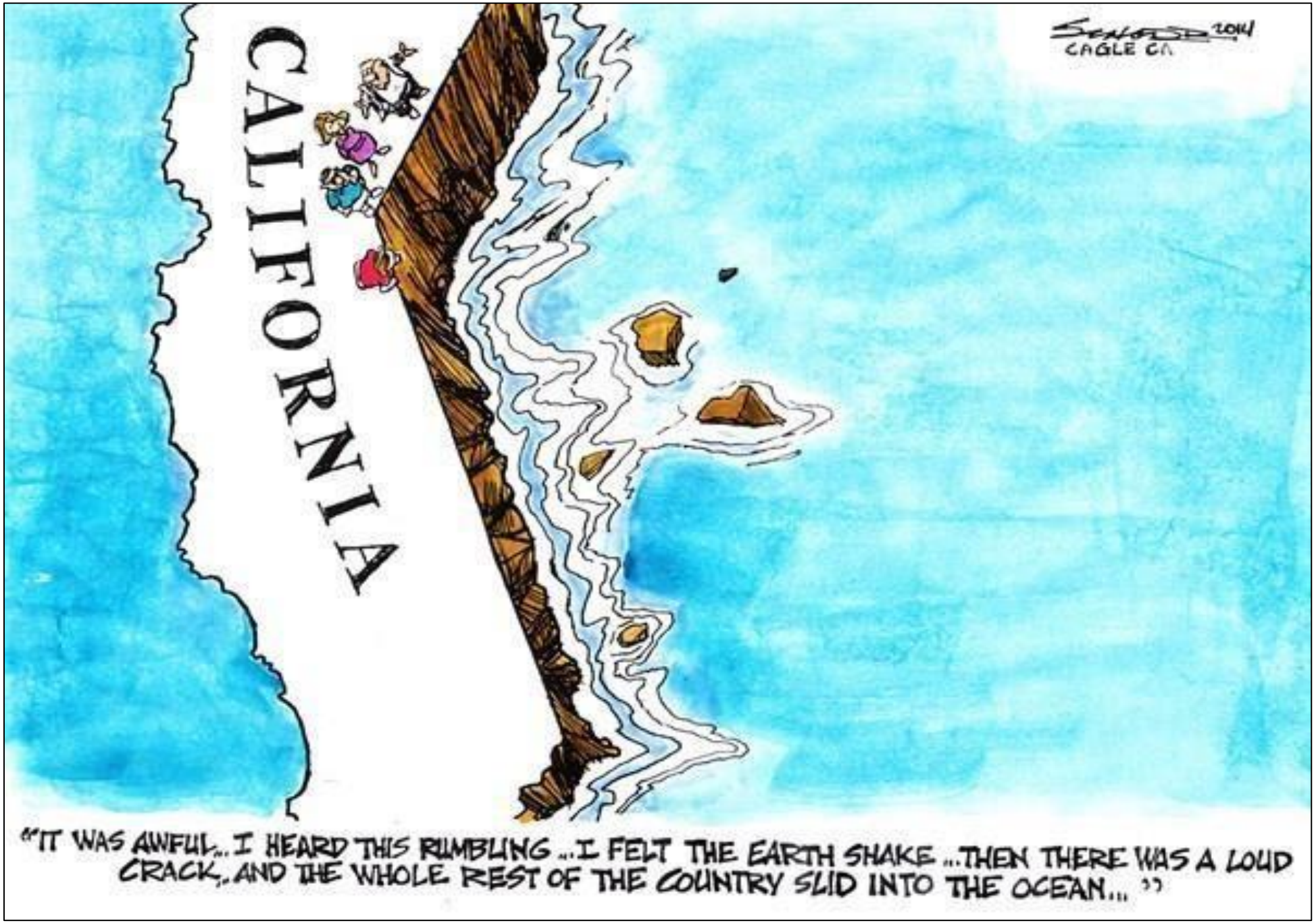


Few countries could be more prepared to handle the devastation of earthquakes and tsunamis than Japan. Disaster plans and preparation include a focus on earthquakesensitive architecture and building codes, emergency personnel training, creating food stockpiles, identifying temporary shelters and raising public awareness. Extreme damage from unanticipated intensities of natural phenomena, however, can overwhelm even the best-laid plans.

In Japan's case, the number of victims, many of whom were buried under debris by the tsunami, created a monumental job for search and rescue teams. The weather following the disasters created major problems for the survivors, as well as the relief team members. For example, northern Honshu's latitude is similar to New York City, making March a brutal month for refugees with limited shelter exposed to snow and sub-freezing temperatures.

Disruption of transportation facilities following the disaster is also a critical issue in evacuating survivors, facilitating search and rescue, distributing food and providing temporary shelters and security. Loss of power, fuel and local water supplies create particular hardships for disaster survivors.

Geography in the News, 2011



Bill Schorr, Cagle Cartoons

PLANTU d'après HOKUSAI

WONSOO
CARTOONKOREA
Seoul
KOREA

CartoonArts International: www.nytsyn.com/cartoons

Ring of Fire Digital Journal

Your Role: You and your partner have been assigned to serve as news reporters, covering two major natural disasters occurring on both the eastern and western boundaries of the Ring of Fire. Your team will be representing one of the two most significant and successful news organizations in the world- the Associated Press (AP) and Reuters.

Your Assignments: Teams who will be working for AP will be assigned to cover the events in Nicaragua and Indonesia. Teams who will be working for Reuters will be assigned to cover the events in Ecuador and Japan.

Research: You have been introduced to each of the natural disasters through the TourBuilder presentation. However, prior to journaling the results of your investigations, you must seek further detailed and reliable information by accessing internet sources. Your team must identify and use the following in your investigation:

a. Two articles written by new organizations or professional organizations (such as scientific or relief groups) about each of the disasters to which you have been assigned.
b. Two photographs for each of the natural disasters. One photograph must depict the impact of the event; one photograph must depict how humans responded to the event.
c. One map of each event, showing the relative location to other nations, cities, and natural landforms or bodies of water.

Focus: Your investigation is not merely to summarize the two events assigned to your team. Your focus should answer these major questions:

1. What were the immediate, as well as long-lasting effects of the natural disaster on the region's environment and human population?
2. How well were humans prepared for the event and how did they respond to the immediate needs of the situation?
3. In what ways are the two events similar?
4. In what ways are the two events alike?
5. As an objective news reporter, what recommendation(s) would you offer to each nation's government in order to better prepare for such ongoing events that occur along the Ring of Fire?

Publication: Create an account (or use a login and password provided by your teacher) for StoryJumper (https://www.storyjumper.com/). Use this web-based program to create an online journal, detailing the results of your investigation. Include photographs you have gathered, as well as detailed information and significant quotes from your online research. Set up your journal in an organized manner; use the lefthand pages of the journal to note information of one event and the righthand pages to note information from the second event (questions 1-2 above). Respond to questions 3, 4, and 5 in a logical order, using the remaining pages of your journal.

- You must note the name of each source used and its URL on a "Sources" page at the end of your journal.

- You will be asked to share your digital journal with classmates. However, your journal will also be published on the internet for other classes around the world to view. So, be accurate and specific in your investigative reporting!